Before the

FEDERAL COMMUNICATIONS COMMISSION

Washington, D.C. 20554

In the Matter of	)	
	)	
Establishment of an Interference Temperature	)	ET Docket No. 03-237
Metric to Quantify and Manage Interference	)	
And to Expand Available Unlicensed	)	
Operations in Certain Fixed, Mobile and	)	
Satellite Frequency Bands	)	

COMMENTS OF THE
UNITED TELECOM COUNCIL

The United Telecom Council ("UTC") hereby submits its Comments on the *Notice of Inquiry and Notice of Proposed Rulemaking* in the above-captioned proceeding.[1] The UTC believes that "interference temperature" is still conceptual and that further study is necessary before it should be introduced in any band, particularly the 6 GHz band that critical infrastructure industries use for microwave communications.

I. INTRODUCTION

UTC is the national representative on communications matters for the nation's electric, gas, and water utilities, natural gas pipelines and other critical infrastructure ("CI") entities. Approximately 1,000 such entities are members of

[1] Establishment of an Interference Temperature Metric to Quantify and Manage Interference and to Expand Available Unlicensed Operation in Certain Fixed, Mobile and Satellite Frequency Bands, ET Docket No. 03-237, Notice of Inquiry and Notice of Proposed Rulemaking, 18 FCC Rcd. 25,309 (2003) ("*Interference Temperature NOI/NPRM*").

UTC, ranging in size from large combination electric-gas-water utilities that serve millions of customers, to smaller, rural electric cooperatives and water districts that serve only a few thousand customers each. Together with the Critical Infrastructure Communications Coalition ("CICC")[2], UTC represents the telecommunications and information technology interests of virtually every utility, pipeline company, railroad and other CI entity in the country.

II. NOTICE OF INQUIRY

A. Interference Temperature Metric/Management

The Commission has defined the interference temperature in general terms, but has left many of the details open. The metric measures RF power generated by undesired emitters plus noise sources that are present in a receiver system (I+N) per unit of bandwidth.[3] Important factors that are left open for comment include: out-of-band emissions, precision of measurements with respect to time, space and frequency, interoperation both among and within measurement systems, and mitigation responses. Assuming that this vague concept can be assessed, the Commission also leaves open the question of costs and benefits to licensees, equipment manufacturers and other potentially affected entities.[4]

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[2] The CICC is composed of the following organizations: The American Gas Association, the American Petroleum Institute, the American Public Power Association, the American Water Works Association, the Association of American Railroads, the Edison Electric Institute, the Interstate Natural Gas Association of America, the National Association of Water Companies, the National Rural Electric Cooperative Association and UTC.

[3] *Interference Temperature NOI/NPRM* at ¶10.

[4] *Id.* at 17.

UTC agrees with the Commission that increased demand for spectrum requires new spectrum management initiatives. However, the concept of a metric is so murky that it is difficult to say whether it would necessarily "provide radio service licensees with greater certainty regarding the maximum permissible interference, and greater protections against harmful interference that could be present at any time."[5] If anything, the metric would appear to be more variable than fixed, as it is based upon the noise floor, which is universally recognized to be different at certain locations and times of day or year. Moreover, as the SPTF Report acknowledged, there is no noise floor study upon which a metric could be based.[6] Even if a proxy could be used, there are larger issues with respect to costs that remain unresolved. In sum, the interference temperature concept needs more baking.

The Commission itself has also recognized that interference management could take any number of forms, ranging from a centralized grid to a decentralized approach, either of which could be coordinated or independent in its response to potential interference.[7] In order to monitor all the different service bands in every area of the country would envision a network of networks that would need to be coordinated between adjacent regions and across spectrum bands. UTC believes that such a network would be incredibly complex and expensive. Nor is it even clear that the technology exists or would be produced

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[5] *Interference Temperature NOI/NPRM*, at ¶ 1.

[6] Spectrum Policy Task Force, Report, ET Docket No. 02-135 at 33 (released Nov. 2002) (stating that the lack of data on the RF noise floor as the foremost hurdle to overcome in order for an interference temperature metric could serve as a useful management tool).

[7] *Interference Temperature NOI/NPRM* at ¶51.

in the near term. Finally, there is no identifiable source of investment to deploy such a network, assuming it could be built. Therefore, it is too early to weigh the costs and benefits of an interference temperature management network.

B. Issues Concerning the General Implementation of Interference Temperature Limits

1. Two frequency bands for unlicensed devices

Although the ultimate goal may be to enable unlicensed underlays in existing bands with licensed services, there is no reason that the Commission must start by testing the concept in those bands.[8] Instead, a network could be deployed in bands that are currently allocated for unlicensed services. Then, that network could be tested to determine if it performed according to specifications. At the same time, the effects on the noise floor could be measured. These effects could be assessed and extrapolated to predict the effects in other bands. More importantly, the testing could be carried out without risking interference to licensed operations, including those of utilities and other critical infrastructure industries.

As the Commission recognizes, the fundamental question is how to define success, regardless of whether the feasibility study is conducted in licensed or unlicensed spectrum.[9] UTC suggests that success would mean that the interference temperature concept enables unlicensed devices to exploit

[8] The Commission states that "although it would be ideal to test this new approach in a frequency band without incumbent services, this is not possible." *Interference Temperature NOI/NPRM* at ¶19. UTC submits that testing in unlicensed bands is certainly a better alternative than testing in bands used for licensed services.

[9] *See Interference Temperature NOI/NPRM* at ¶ 20.

opportunities that exist above the noise floor without raising it above quasi-peak levels. In that way, the Commission would promote greater access to spectrum for unlicensed devices without compromising the design parameters upon which licensed services were constructed, thereby potentially undermining their integrity and reliability.

2. Technical factors in setting interference temperature limits

Apart from the factors suggested by the SPTF, UTC suggests that the Commission base the interference temperature upon the noise floor in a given band in a given area, and then determine the appropriate margin above the noise floor based upon the probability of interference to incumbents in those bands. UTC agrees with some, but not necessarily all of the factors suggested by the SPTF Task Force. For example, the extent of current use would certainly be a valid factor in bands that are already congested, as is the case in the PLMR bands below 512 MHz. However, there may be bands that are relatively uncongested, but which are likely to become congested in the future, or that are used for licensed communications that for technical or public policy reasons should be controlled by a stringent interference temperature limit. Certainly, UTC agrees that the Commission should factor the types of services offered, the types of licensees, the criticality of the services and the susceptibility of those services to interference. Only by developing interference temperature limits tailored to the noise floor, and which also account for the types of services/licensees in each band, as well as the probability of interference to those services, may the

Commission achieve its twin goals of meeting demand for new wireless services without jeopardizing incumbent licensed operations.[10]

Clearly, interference temperature limits must be both qualitative and quantitative. As such, factors such as modulation schemes may mitigate the probability of interference, and hence the limit that should apply. Conversely, incumbents' susceptibility to interference may require a more stringent limit in order to protect the receivers that are most vulnerable to interference in certain bands.[11] Owing to the qualitative nature of these factors some should be accorded more weight than others. But, the acid test for weighing these factors must be the Commission's public interest mandate under the Communications Act.

3. Approach for measuring interference temperature on a real time basis/communicating to devices

The implementation of the metric measurement and the response system raises larger questions that cast further doubt on the viability of the concept as a whole. UTC is unaware of any system on the market or in development upon which it could even venture a cost estimate. It would also be unreasonably speculative to suggest a monitoring scheme without more information. In any event, UTC opposes requiring licensees to assume any funding obligation to develop and deploy such systems. Those costs should be borne solely by the manufacturers and the unlicensed operators that would directly benefit from

[10] *See generally Interference Temperature NOI/NPRM* at ¶21.

[11] The Commission is currently examining receiver standards, and will determine in that proceeding whether licensees must improve the interference characteristics of their facilities.

them. UTC also has serious questions about the effectiveness of monitoring, both in terms of the bandwidth and the geographic area covered.[12]

4. Responses to measurements

In addition, information must be both conveyed *and processed* in real-time, requiring complex coordination between geographic areas and specific bands. Again, it is uncertain at this time whether such real-time communications is possible.[13] Assuming such communications could be supported, possible mitigation responses could include frequency shifting, notching or complete shutdown – the important thing is that the response be coordinated between geographic areas and spectrum bands, which would likely require a centralized network of some type. Moreover, there must be an enforcement mechanism to ensure compliance, otherwise the interference temperature concept may lead to a "tragedy of the commons."[14] UTC does not believe that the Commission should rely on technology alone, but should oversee the performance of measurement networks, at least temporarily, and sanction non-compliance.

C. Noise Floor Measurements

UTC agrees with the Commission that the interference temperature concept is dependent upon an understanding of the condition of the RF

See Interference Immunity Performance Specifications for Radio Receivers, Notice of Inquiry, ET Docket No. 03-65, 18 FCC Rcd 6039 (2003).

[12] *See generally Interference Temperature NOI/NPRM* at ¶18-19. *See also* Comments of UTC infra at section II. A.

[13] *See Interference Temperature NOI/NPRM* at ¶¶ 22-23.

[14] *See generally* SPTF Report at 39-40.

environment, *i.e.* the noise floor.[15] The problem is that there is no comprehensive data on the noise floor in all the bands currently available. Nor is it easy or inexpensive to collect.[16] Therein lies the rub. The Commission should collect noise floor measurements using publicly available data after public comment and review, utilize that data to develop (no pun intended) a sound basis for the interference metric. To the extent that no such data is available, the Commission should conduct its own measurements. As with the R&D to develop monitoring networks, funding for measuring the noise floor should come from manufacturers and unlicensed service providers that would benefit directly from such measurements.

D. Determining Harmful Interference

Oddly it has taken this proceeding for the Commission to attempt to define harmful interference. Thus far, harmful interference, like obscenity, has escaped definition, but you know it when you see it.[17] UTC fully supports this initiative, but believes that it should be taken up in a separate proceeding, given the significance of this issue. As much as it would be convenient to determine a specific measure for harmful interference, it would not only be a function of the service in a frequency band but also a host of technical variables for a given facility. Plus, certain services are capable of tolerating more interference in a given band than others in the same band.

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[15] *Interference Temperature NOI/NPRM* at 24.

[16] *See* SPTF Report at ¶¶28-29, *and Interference Temperature NOI/NPRM* at ¶ 26.

[17] *See* Jacobellis v. State of Ohio, 84 S. Ct. 1676, 1683 (1964)(Stewart, J concurring)(declining to define pornography, but stating that "I know it when I see it.")

For purposes of the interference temperature concept, UTC recommends that the FCC follow a "safe harbor" approach. Not only would this avoid the difficult issues of defining "harmful interference" for all bands, services and facilities; but also it would provide a margin for error that quite frankly is necessary, given the untested concept that is under consideration. A safe harbor could conceivably be developed, but again would depend on a better understanding of the noise floor.

III. NOTICE OF PROPOSED RULE MAKING

A. The FCC Should Not Test the Interference Temperature Concept in the 6 GHz Band, Which is Heavily Used for Critical Infrastructure Communications.

UTC opposes the proposal to test the interference temperature concept in the 6 GHz band. Not only is the concept vague and should be tested first in unlicensed bands, but the 6 GHz band is heavily used for critical infrastructure communications. A search of the FCC's records revealed that there are over 24 thousand frequencies licensed for fixed services in the 6525-6700 MHz band. A review of the licensees indicates that over nine thousand of those frequencies are licensed to over three hundred critical infrastructure companies throughout the country.

These licensees rely on the microwave facilities in the 6 GHz band for radio backhaul, voice, administrative data, SCADA control and telemetering, protective relaying and other communications. An informal survey of UTC members found that on average 22% of the traffic is radio backhaul, 24% is voice, 28% is administrative data, 10% is SCADA control and telemetering, 20%

is protective relaying and 5% is other communications. Members reported that loss of radio backhaul communications would prevent timely response to energy delivery system problems; loss of internal and external voice communications would similarly impair routine and emergency services to the public; loss of administrative data would also impair service restoration and repair; and most importantly – loss of SCADA and protective relaying would create the potential for widespread outages and other threats to public safety.

Critical infrastructure companies engineer these microwave systems to meet high standards for service reliability. For example, the Western Electricity Coordinating Council[18] prescribes standards for protective relaying that require up to 99.95% reliability.[19] The WECC guidelines for the design of critical infrastructure communications circuits recommends microwave circuits be at a composite signal level between 15-20 dBm, and at the same time be at a minimum of 6 dB above the manufacturers guaranteed threshold of operation.[20] These exacting tolerances must be maintained in order to meet demanding standards that

[18] The Western Electricity Coordinating Council was formed on April 18, 2002 by the merger of the Western Systems Coordinating Council (WSSC) and the Southwest Regional Transmission Association (SWRTA) and the Western Regional Transmission Association. As the largest of the ten regional reliability councils under the North American Reliability Council (NERC), its electric utility members comprise a service territory of 1.8 million square miles that extends from Canada to Mexico, including the provinces of Alberta and British Columbia and the northern portion of Baja California and all or portions of the 14 western states in between. *See* www.wecc.biz/about.html.

[19] Western Electricity Coordinating Council, Communications Systems Performance Guide for Protective Relaying Applications, at 6 (2001).

[20] Western Electricity Coordinating Council, Guidelines for the Design of Critical Infrastructure Communications Circuits, at 6 (2002).

apply to both teleprotection systems (response times of 20 milliseconds or less) and event-monitoring systems (resolution times of 1 millisecond). [21]

Particularly after the Northeast blackout on August 14, 2003, electric transmission reliability is the mantra for the industry. Estimates of the economic cost of the Blackout are between $6.8 and $10.3 billion dollars.[22] The NERC Blackout Recommendations issued last year require electric utilities to take specific actions to correct deficiencies that caused the blackout and to implement strategic and technical initiatives to prevent future blackouts. Those recommendations include ongoing audits of the 20 highest priority areas that make up 80% of the electric demand.[23] In addition, the GAO just released a report on SCADA security that cites "insecure connections" including wireless communications systems that may exacerbate vulnerabilities.[24] As such, the utility industry and the general public welfare can ill afford at this time to

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[21] *See* Utilities Spectrum Assessment Task Force Report, at 14. ("USAT Report") *See also* National Telecommunications and Information Administration, Current and Future Spectrum Use by Energy, Water and Railroad Industries, Report to Congress (released Jan. 2002) at http://www.ntia.doc.gov/osmhome/reports/sp0149/sp0149.pdf (citing USAT Report). *And see* IEEE PSRC Working Group H5 Report to the Communications Subcommittee, Application of Peer-to-Peer Communications for Protective Relaying (rel. Dec. 22, 2000) at http://grouper.ieee.org/groups/c37/115/H5Documents/H5DOC.pdf (listing various relay applications and the reporting the performance requirements for each application).

[22] ICF Consulting, The Economic Cost of the Blackout: An Issue Paper on the Northeast Blackout August 14, 2003, at http://www.icfconsulting.com/Markets/Energy/doc_files/blackout-economic-costs.pdf.

[23] *See* NERC Blackout Recommendations at ftp://www.nerc.com/pub/sys/all_updl/docs/blackout/BOARD_APPROVED_BLACKOUT_RECOMMENDATIONS_021004.pdf

[24] *See* United States General Accounting Office, Report to Congressional Requesters: Critical Infrastructure Protection, Challenges and Efforts to Secure Control Systems at 13 (March 2004) ("GAO Cyber Security Report").

potentially compromise the reliability of SCADA systems that depend on these microwave systems to deliver essential services safely and efficiently.[25]

Finally, testing the interference temperature concept in the 6 GHz band threatens to cause enormous stranded and frozen investment in utility microwave systems. Many of these systems were recently relocated from the lower 2 GHz bands, which were reallocated for PCS in 1993.[26] As such, these facilities are nowhere near depreciated.[27] Moreover, several of the utilities surveyed by UTC were planning on investing millions to upgrade their 6 GHz analog and digital microwave systems. Testing the interference temperature concept in the 6 GHz band would put those plans on hold.

B. Critical Infrastructure Communications Must Be Protected if the Metric is Tested in the 6 GHz Band.

1. DFS Threshold for FS operations in the 6 GHz Bands

The Commission has proposed to establish a dynamic frequency selection (DFS) threshold for unlicensed operations in the 6 GHz band. It believes the potential of interference from unlicensed operations is mitigated because there is already significant sharing among licensed FS operations at much higher power levels using high-gain antennas; FS operations are generally isolated; unlicensed

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[25] *See also* GAO Cyber Security Report at 17 (reporting cyber attacks carried out on a variety of utility SCADA systems).

[26] *Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies*, First Report and Order and Third Notice of Proposed Rule Making, 7 FCC Rcd. 6886 (1992) (reallocating the 1.8-2.2 GHz bands for PCS and relocating fixed services to preferably the 6 GHz band). *See also* NTIA Report 92-286 in ET Docket 92-9 (filed Aug. 11, 1992) (recommending that 2GHz non-government incumbents relocate to the 6 GHz band rather than the 1710-1850 MHz band).

[27] Typically utility assets are depreciated upon 25-year cycles.

operations would be located on divergent paths from FS receive antennas; and rooftop microwave and in-building unlicensed transmitters would be shielded from each other.[28]

Based on these assumptions, the Commission has invited comment on the amount of attenuation and assumed minimum typical separation distance necessary to protect incumbent microwave facilities from interference. It also proposes a signal to interference (S/I) ratio of 30 dB to 50 dB, and has performed a link-budget analysis that purports to show that this S/I ratio would protect incumbents, even if the unlicensed transmitter were operating on a channel currently in use by a fixed station. [29]

UTC challenges some of the assumptions built into the proposed DFS threshold. Typically, utility FS operations do tend to be located in isolated areas, but many are collocated with other operations in open areas on towers and are not shielded by buildings. And although it is true that microwave operations are high power and use high-gain antennas, their signals are highly vulnerable to interference, particularly over flat terrain and in foggy conditions or over lakes. UTC can envision a scenario in which those conditions exist, but are undetected by the monitoring system. In such a scenario, the monitoring system might see a strong microwave signal at the tower and permit unlicensed devices to transmit and interfere with a microwave path that is in fact weak at some point in between the towers because of these conditions. Faulty assumptions such as these about

[28] *Interference Temperature NPRM/NOI* at ¶40.

[29] *Id.* at ¶43.

the relative power of microwave paths and the separation distances of unlicensed transmitters must be addressed before the interference temperature concept is tested in the 6 GHz band.

2. General In-Band Considerations/Out of Band Emissions

The Commission has requested comment on the maximum transmit power, maximum spectral power density, antenna gain and other related technical limits that might apply to unlicensed operations in the 6 GHz band. As noted above, the Commission proposes to permit ERP of 24 dBm to 30 dBm and EIRP in the range of 30 dBm to 60 dBm, but it has asked for alternative technical limits, supported by detailed analysis including at least a link budget. Finally, the Commission has suggested the possibility of restricted bands of operation and asked for comment on borrowing the out-of-band emission standards that apply to U-NII devices and applying them in the 6 GHz band.

UTC cautions the Commission against relying exclusively on abstract calculations of a link budget to determine acceptable power limits for unlicensed operations in the 6 GHz band. Such calculations would not account for the reliability standards that critical infrastructure communications systems must meet. Moreover, there are numerous variables that could make an abstract calculation fruitless. The risk of error is particularly high for microwave, because interference is likely to result in complete loss of communications between links, not merely reduced coverage, as might be the case for mobile services.[30]

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[30] *See e.g. Report: Second Meeting of the Technical Advisory Council III* at 3 http://www.fcc.gov/oet/tac/meetings_2003-2002.html (describing a pragmatic approach to defining noise and interference in terms of impact on performance to a specific system.)

Therefore, if the Commission insists on testing the metric in the 6 GHz band, the Commission must develop limits on power and other operational parameters, such as out-of-band emissions, that ensure that critical infrastructure communications integrity is maintained.

IV. CONCLUSION

UTC applauds the FCC for investigating new ways to manage available spectrum to create opportunities for new services without adversely affecting incumbent licensed services. Clearly, more study and equipment development is necessary before the concept of an interference temperature metric should be implemented in any band, let alone the 6 GHz band, which all critical infrastructure companies use for microwave services to support a variety of core services, and which electric utilities are particularly dependent upon to ensure the reliability of transmission lines following the Northeast blackout. UTC looks forward to working with the Commission on this important initiative.

Respectfully submitted,

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